Application of the Six Sigma Process to Service Quality Improvement in Fitness Clubs: A Managerial Perspective

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Since "Fitness Clubs" are in a service-oriented industry, methods for maintaining high quality and customer satisfaction have become a significant issue. In this study we have applied the Six Sigma Process, implementing its five recommended steps in order, with aim of reducing the incidence of service failures at Fitness Clubs in Taiwan. The first step of the Six Sigma Process is to define, and the defined result is to minimize the occurrences of service failures. Secondly, the number of occurrences is used to determine a measurement index and find out the measurement criterion. Then, Pyzdek's (2001) theory is taken as the tool in the third step to analyze the cause of service failure. Applying the causes clarified by the cause and effect diagram, the forth step aims to determine the responsibilities of each department and organize the quality improvement teams based on Quality Function Deployment. Finally, the measurement criterion elicited in the second step is employed to verify whether the strategies for improvement obtained in the fourth step are feasible. If meeting the standard, then the criterion can be used for further control. The five-step Six Sigma Methodology can effectively minimize service failures while improving customer satisfaction and service quality, as well as ensuring sustainable management for enterprises.

1. Introduction

Since the industrial structure has changed, the output value and employed population in service industries have become key indicators of the national economy. According to a survey from the Directorate-General of Budget, Accounting, and Statistics, the output value of the service sector has contributed over 50% of Taiwan's GNP since 1988. The services sector has grown dynamically in recent years. In the 3rd quarter of 2007, the service sector made up 69.07% of the economy and therefore became a major industry in Taiwan. All services share four unique characteristics— intangibility, perishability, inseparability, and heterogeneity (Parasuraman, Zeithaml and Berry, 1985). Inseparability is used to describe a key quality of services as distinct from goods. The characteristic of service renders it impossible to divorce the supply or production of the service from its consumption. When a service is provided, a service failure might occur and cause complaints and discontent. However, attempting to provide a service without failure or mistakes is definitely a difficult task. Service failure is inevitable, and improper service recovery solutions might further upset customers. Thus, timely solutions and good recoveries to the service failures are needed since that can increase customer satisfaction and turn frustrated customers into loyal customers.

Due to increasing consumer awareness, customers tend to make varied requests and they expect more services from enterprises. Service industries have become more competitive. In pursuit of a sustainable operation, it's necessary for enterprises to know

how to attract new customers while keeping existing ones. Luo (2001) pointed out that acquiring new customers costs 3-10 times more than holding on to existing customers. If an enterprise is unable to keep existing customers, it will have to pay more to find new ones. Reichheld and Sasser (1990) also observed that, as little as a 5% reduction in customer churn can boost enterprises' net profits by as much as 25% to 85% (depending on the types of industry). Hence, it's extremely important for enterprises to maintain client loyalty, both on a cost basis and profit basis.

Since 2001, the Taiwanese have started to take two days off per week. People have more free time and attach more importance to sports and activities, which has led to the emergence of professional fitness clubs and higher market demands. Because the fitness club industry is a service-oriented industry, maintaining high quality and customer satisfaction has become a significant issue. Basically, the key is to provide high quality service and minimize service failures. Thus, this article aims to diminish service failures in fitness clubs by using a Six Sigma methodology.

Six Sigma was originally developed by Motorola in 1987 when the company was facing difficulties in maintaining quality. At that time, Mikel Harry and Richard Shoreder introduced the Six Sigma strategy to Motorola for product quality control. By1997, the company had promoted the strategy for ten years. Sales volume had maintained a five-fold growth each year and net profit had increased almost 20%, and costs were reduced by US$14 billion. The company's efforts were recognized by the Malcolm Baldrige National Quality Award in 1988. After Motorola's success, General Electric also adopted Six Sigma with outstanding results. Thereafter, more and more enterprises have begun Six Sigma initiatives, such as Sony, Citibank, Ford Motor, and Texas Instruments.

The Six Sigma (6σ) process is composed of five phases (Michael, 2002):

(1) Define: Define the problem and the project goals.

(2) Measure: Measure key aspects of the current process.

(3) Analyze: Analyze the root cause of the defect.

(4) Improve: Improve the current process.

(5) Control: Control the future process and implement control systems. Ensure that the results are accurate and stable.

2. Define and Measure

As noted, since "Fitness Clubs" are in a service-oriented industry and maintaining high quality and customer satisfaction has become a significant issue. Schibrowsky and Lapidus (1994) indicated that, if an enterprise loses its customer, it needs additional inputs, which cost five times more than keeping existing customers. Tax, Brown and Chandrashekaran (1998) also found that if a firm can deal successfully with service failures, customer churn rate will be reduced and the negative impacts of the complaints will be alleviated.

(1) Define

The first phase of the process of Six Sigma is to define. Its goal is to reduce service failure rates. In general, most service failures that have occurred in fitness clubs are: defects in service delivery systems, low quality of products, or ill-equipped facilities. When we use "X" as the number of failures that occur in a fixed period of time, "X" is the random variable of count, where it's also the number of defects of a product. According to Montgomery (2001), the attributes' random variable X obeys the Poisson distribution, and the probability density function is presented as:

$$P(\mathrm{X}) = \frac{\lambda^{\mathrm{X}} e^{-\lambda}}{\mathrm{X}!}, (\mathrm{X}=1, 2, 3, \ldots, \mathrm{N}, \ldots \infty)$$

The parameter λ is the mean and variance of the service failure occurrences, where $E(\mathrm{X}) = \lambda$, $Var(X) = \lambda$. Minimizing service failures is the top priority. Nevertheless, failures occur. In order to achieve the goal, enterprises can determine an upper bound for the number of service failures based on expectations, number of customers, and external competitors. This upper bound "U" will be the maximum tolerance of service failures.

(2) Measure

λ is used as the average number of service failures, while U is the upper tolerance limit of service failure. The measurement index "L_{Index}" used in the study is thus defined as follows:

$$\mathrm{L}_{\mathrm{Index}} = \frac{\lambda}{\mathrm{U}} \times 100\%$$

If the average number of service failures equals the upper bound (λ = U), the measure index will be: L_{Index} = 100%, that is, the occurrences of service failures have reached the tolerance limit. When the average number of service failures is greater than the upper bound (λ > U), the measure index will be: L_{Index} > 100%, which means the occurrences of service failures have exceeded the tolerance limit; on the contrary, if the average number of service failures is less than the upper bound (λ < U), the measure index is: L_{Index} < 100%, namely, the failure occurrences are within a permissible range. Apparently L_{Index} is the increasing function of the service failure average and variance. When λ is small, it stands for high quality service, and therefore the measure index "L_{Index}" is expected to be small. According to Chen, Chen and Li (2002), when a company expects that its service quality should be: $L_{Index} \leq \nu$ (0 < ν < 1), the smaller the ν is, the stricter the demand for its service quality. If the number of ν is large, the requirement for service quality is competitively lenient.

We will first describe the hypothesis for measurement as follows:

H_0 : L_{Index} ≤ ν (good service quality)
H_a : L_{Index} > ν (poor service quality)

H_0 is of null hypothesis, that is, when measurement index "L_{Index}" has a demand smaller than or equal to the service quality performance parameter ν, it satisfies the null hypothesis, and it also means that the service quality meets the demand; otherwise, it

satisfies the alternative hypothesis of H_a, indicating that the service quality fails to meet the demand.

(3) The Uniformly Minimum Variance Unbiased Estimator of the Measurement Index and the Procedures of Measurement

The study uses the uniformly minimum variance unbiased estimator "$\hat{L}_{index}$"of the measurement index "L_{Index}" as the measurement statistic. Uniformly minimum variance unbiased estimator "$\hat{L}_{index}$" refers to the mathematical formula of the smallest variance in all unbiased estimators. The definition is shown as follows:

$$\hat{L}_{Index} = \frac{\overline{N}}{U} \times 100\%$$

$\overline{N} = (\sum_{j=1}^{k} N_j)/k$ is the sample mean that covers all types of service failures. The estimator is the sum of actual service occurrences ($N_1+N_2+....+N_k$) divided by k. The following figure shows the relationship between the measure index and the estimator.

Then, the mean (expected value) and variance of the Uniformly minimum variance unbiased estimator "$\hat{L}_{index}$" will be as follows:

Figure 1. The Sampling Distribution of Sample Means

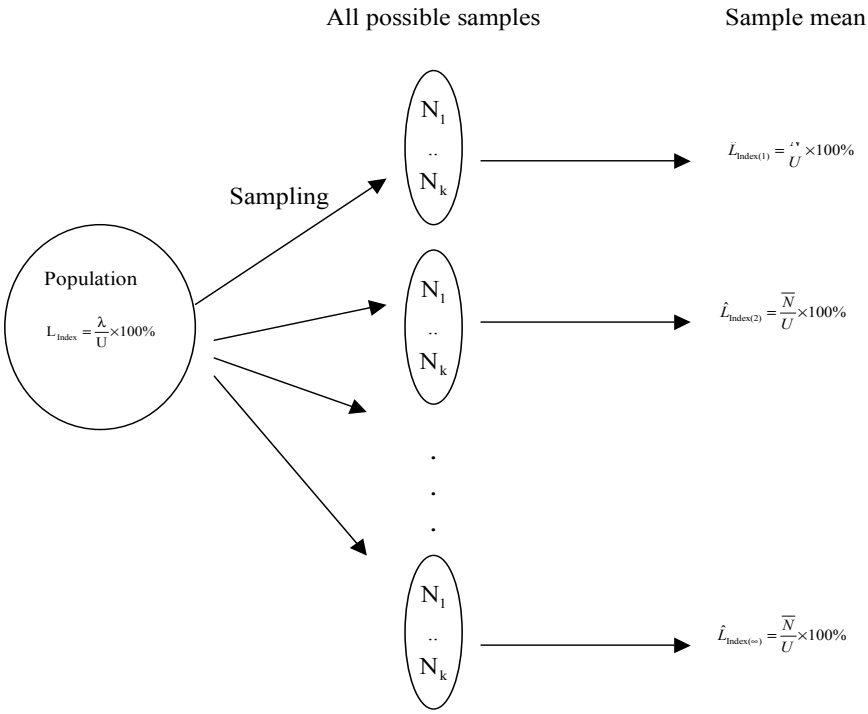


Table1. Calculation Process of L_{Index} Mean

Calculation Process		Footnote
$E(\hat{L}_{index}) = E(\frac{\overline{N}}{U})$	(F1)	$\hat{L}_{Index}=\frac{\overline{N}}{U}$, then $E(\hat{L}_{index})=E(\frac{\overline{N}}{U})$
$=\frac{1}{U}E(\overline{N})$	(F2)	take out $\frac{1}{U}$, and $\overline{N}=\frac{\sum_{j=1}^{k}N_j}{k}$
$=\frac{1}{U}E(\frac{\sum_{j=1}^{k}N_j}{k})$	(F3)	take out $\frac{1}{k}$
$=\frac{1}{kU}E(\sum_{j}^{k}N_j)$	(F4)	$\sum_{j}^{k}N_j=N_1+N_2+...+N_k$
$=\frac{1}{kU}E(N_1+N_2+...+N_k)$	(F5)	substitute E
$=\frac{1}{kU}[E(N_1)+E(N_2)+...+E(N_k)]$	(F6)	since $E(X)=\lambda$, where N_k is the probability of X, then $E(N_k)=\lambda$
$=\frac{1}{kU}[\lambda+\lambda+...+\lambda]$	(F7)	add up λ (if k is the probability given), then we have λk
$=\frac{1}{kU}(\lambda k)$	(F8)	
$=\frac{\lambda}{U}=L_{Index}$	(F9)	since $L_{Index}=\frac{\lambda}{U}$, we have shown that $E(\hat{L}_{index})=L_{Index}$

Table2. Calculation Process of L_{Index} Variance

Calculation Process	Footnote
$Var(\hat{L}_{index}) = Var(\frac{\overline{N}}{U})$ (F1)	$\hat{L}_{Index}=\frac{\overline{N}}{U}$,then $Var(\hat{L}_{index}) = Var(\frac{\overline{N}}{U})$
$=\frac{1}{U^2}Var(\overline{N})$ (F2)	take out $\frac{1}{U}$, and $\overline{N}=\frac{\sum_{j=1}^{k} N_j}{k}$
$=\frac{1}{U^2}Var(\frac{\sum_{j=1}^{k} N_j}{k})$ (F3)	take out $\frac{1}{k}$
$=\frac{1}{k^2U^2}Var(\sum_{j}^{k} N_j)$ (F4)	$\sum_{j}^{k} N_j=N_1+N_2+...+N_k$
$=\frac{1}{k^2U^2}Var(N_1+N_2+...+N_k)$ (F5)	substitute Var
$=\frac{1}{k^2U^2}[Var(N_1)+Var(N_2)+...+Var(N_k)]$ (F6)	since $Var(X)=\lambda$, where N_k is the probability of X, then $Var(N_k)=\lambda$
$=\frac{1}{k^2U^2}[\lambda+\lambda+...+\lambda]$ (F7)	add up λ (if k is the probability given), then we have λk
$=\frac{1}{k^2U^2}(\lambda k)$ (F8)	
$=\frac{\lambda}{kU^2}=\frac{1}{kU}\times\frac{\lambda}{U}=\frac{L_{index}}{kU}$ (F9)	since $L_{Index}=\frac{\lambda}{U}$, we have shown that $Var(\hat{L}_{index})=\frac{L_{index}}{kU}$

Given that the test statistic is calculated by the observed value of a random sample, then $\hat{L}_{index} = w$, and under the rule of the null hypothesis, $L_{index} = v$, and thus:

$$P - value = P(\hat{L}_{index} \geq w \mid L_{index} = v)$$

As noted, $E(\hat{L}_{index}) = L_{index}$, and $Var(\hat{L}_{index}) = \frac{L_{index}}{kU}$, then the test statistics will be:

$$\frac{(\hat{L}_{index} - L_{index})}{\sqrt{\frac{L_{index}}{kU}}} = \frac{\sqrt{kU}\,(\hat{L}_{index} - L_{index})}{\sqrt{L_{index}}} = \frac{\sqrt{kU}\,(w - v)}{\sqrt{v}}$$

A Poisson distribution can be applied in a case with a large number of possible events, Based on Z-distribution, $P - value = P(\hat{L}_{index} \geq w \mid L_{index} = v)$ will be changed into:

$$P - value = P(Z \geq \frac{\sqrt{kU}\,(w - v)}{\sqrt{v}})$$

Based on the above-mentioned theories, the procedures of 6-Sigma measurement steps are set up as follows:

A. Given a sample of *k*, we estimate that the value is: $\hat{L}_{index} = w$.

B. The P-value is calculated with the v value, and then compared with the significant level α (mostly $\alpha = 0.05$ or 0.01).

C. Verify whether service quality has met the standard:

(a) If P-value $\geq \alpha$, H_0 is not rejected, thus service quality has met the standard.

(b) If P-value $< \alpha$, H_0 is rejected, which means service quality has fallen short of the standard.

3. Analysis

After defining the problem and determining the measure mode, a cause and effect diagram is constructed as an analytic tool, in accordance with Pyzdek's (2001) theory. Since the market is competitive and customers expect excellent service quality, the most efficient means to enhance service quality and customer satisfaction is to improve service failures. There are many factors that may cause service failures, and this article probes into the main factors through six aspects: defects in service delivery systems, products below expectations, ill-equipped facilities, employee characteristics, employees' responses to customers' requests, and problem behaviors of customers.

Based on the cause and effect diagram, the six factors of service failure were analyzed and stated as follows:

(1) Defects in the Service Delivery System

Even though fitness club owners set the standard of service quality in accordance with customers' requirements, customers might find the service imperfect due to staff faults or other uncertain factors. Therefore, service quality will be impacted during the

service delivery process. The most common faults of staff are improper attitude or slow service.

(2) Products below Expectations

This is experienced when instructors do not follow the announced syllabus in exercise classes, and/or they do not care about customers' opinions. Or, there might be flaws in the sporting goods sold in the fitness clubs, but the after-sale service does not meet the expectations of customers. In these cases, service failure occurs.

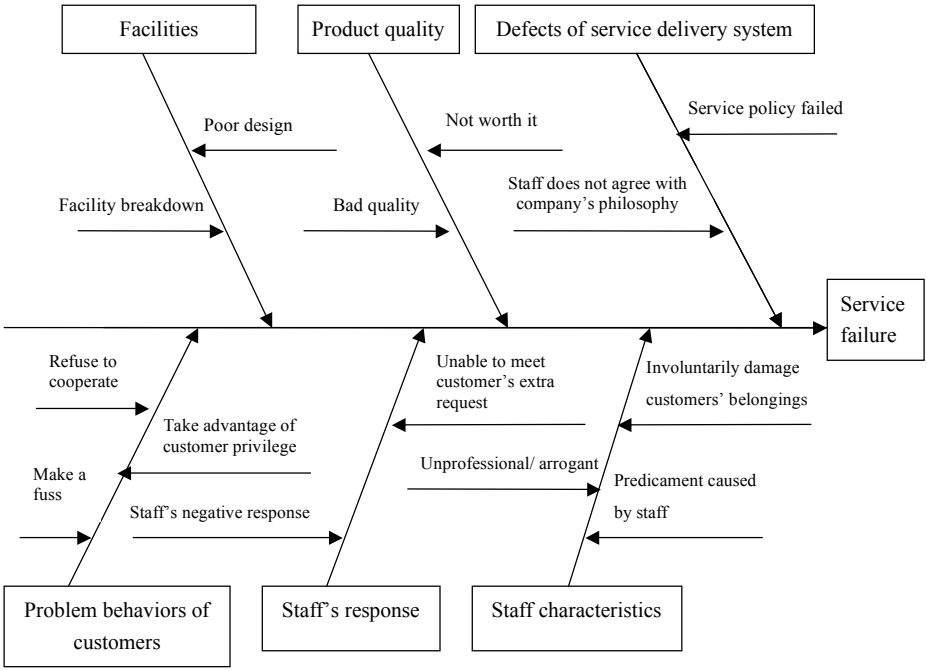
(3) Ill-equipped Facilities

Due to limited budgets, some fitness clubs can not purchase the latest in equipment regularly, or their equipment are maintained by outside maintenance providers instead of a professional maintenance staff. Thus, these fitness clubs are unable to provide a fully-equipped sporting environment for customers.

(4) Employee Characteristics

Not all club staff menbers have experience or an education in sports, and some of the employees do not receive in-service training due to limited work hours and budgets. Consequently, these employees lack professional service attitude and are incapable of satisfying customers.

Figure 2. Cause and Effect Diagram of Service Failure in Fitness Club



(5) Employees' Responses to Customers' Requests

In order to minimize human resource cost, some fitness clubs are short-staffed. The employees' responses to customers' requests and speed of service may displease customers due to the employees' heavy workload or insufficient authority.

(6) Problem Behaviors of Customers

Though there are instructions for the equipment and facilities, some customers will not follow the instructions — mainly because of a feeling of customer privilege or personal dissatisfaction. In this circumstance, staff may be unable to handle these types of clients properly and cause a service failure. The most common problem behaviors include: neglect of instructions, damage to equipments or products, incorrect or incomplete information, missed date, changed mind, unfamiliar with procedures, lost property, extra requests from customers, not returning things back, or verbal provocation.

4. Improvements

(1) Body-Building Dept.

A. Defects in the Service Delivery System

Strengthen communication and coordination among departments and optimize teamwork in order to let the staff learn that only professional skills and proper attitudes can provide high quality service.

B. Quality of Products below Expectations

Develop diversified, specialized, and interesting courses and programs for individual sports with ancillary equipment. In addition, design tailor-made products for different kinds of clients, such as low-impact exercises for the elderly, stress-release exercises for white-collar workers, and challenger sports for students.

Table 3. Correlation Coefficient Matrix Analysis.

Cause and Effect \ sector	Body-Building Dept.	Membership Service Dept.	Marketing Dept.
Defects in the Service Delivery System	◎	◎	◎
Products below Expectations	◎	○	◎
Ill-equipped Facilities	◎	○	○
Employee Characteristics	◎	◎	◎
Employees' Responses to Customers' Requests	◎	◎	◎
Problem Behaviors of Customers	◎	◎	◎
◎ refers to direct relevance; ○ refers to indirect relevance			

C. Ill-equipped Facilities

Apply indoor perspectives on indoor design. Use glasses and movable partitions in the club to keep the space open. Purchase new equipment during a certain period. Set checklists for equipment maintenance and cleaning. Check the equipment with the checklists before allowing them to be used. Inform maintenance personnel immediately when broken equipment is discovered. Also, staff should ensure a clean environment while on duty so that customers can feel comfortable.

D. Employee Characteristics

Improve instructors' professional activities during fitness courses and improve staff understanding of the equipment. Provide staff training on emotional management and communication skills. Give encouragement or individual training if needed.

E. Employees' Responses to Customers' Requests

Employees are required to take care of customers' requests and opinions. Pay attention to the uses of equipments. Customize fitness programs for certain customers (elderly, overweight people, pregnant women, etc.) and provide a one-on-one consulting service.

F. Problem Behaviors of Customers

While designing physical facilities and user's rules, the fitness club owner should also consider how to prevent misuse of equipment, so that client-caused failure won't occur. The zero-defect concept of quality management can be used during the design process. For example, fitness clubs can remind customers to use their time efficiently and promote the safe-keeping of personal belongings, simplify forms, as well as ameliorate circulation design. Moreover, the fitness instructors and club attendants should improve their capabilities in crisis intervention and conflict management, and learn how to admonish customers with a tactful attitude if there is any improper behavior or misuse of equipments.

(2) Membership Service Department:

A. Defects of Service Delivery System

Strengthen staff training for Membership Service clerks, especially regarding their service attitudes. The staff should serve customers based on the strategy of customer relationship management — especially those who are frustrated with the products or services. The overall goals are to find, attract, and win new customers, while nurturing and retaining those the company already has.

B. Employee Characteristics

Hold growth camps for enhancing staff cohesion; Offer staff incentives for excellent staff and give warnings to unprofessional ones.

C. Employees' Responses to Customers' Requests

Since the service industry is always capricious and challenging, membership service clerks should strengthen their work ability. They should be equipped with a sincere manner, flexible body language, ability to memorize customers' names, complaisance, problem-solving skills, and ability to provide advice.

D. Problem Behaviors of Customers

Improve the staff's crisis management and emotion management skills. Empower staff adequately so that the front-line staff can comfort unsatisfied customers within the shortest amount of time and deal with customers' problems or complaints in accordance with customer service guidelines.

(3) Marketing Department:

A. Defects of Service Delivery System

Fulfill the ISO concept and standardize company's products and services. Profound understanding of company's products, philosophy, and customer information is required.

B. Employee Characteristics

Knowledge of marketing, products, markets, users, as well as communication skills, interpersonal relationship, organizational ability, and decision-making capacity are the key elements of a marketing professional. The marketing staff should learn the product features, customer needs, and market characteristics, and then deliver accurate and complete messages to the customers.

C. Employees' Responses to Customers' Requests

Staff should have empathy with customers and they should encourage customers to express their feelings and opinions about the fitness club. If customers are displeased, take immediate action to solve the problem or ask a supervisor for instructions.

D. Problem Behaviors of Customers

In order to prevent cognitive mistakes during the promotion of products that result in a service failure, the marketing staff can use product brochures or instruction manuals to introduce products—especially to new customers. If there's any misunderstanding of the products or system, the staff should thoroughly explain them to the customers. Furthermore, staff should become familiar with related regulations and measures in order to deal with the problem behaviors of customers. Also, emotion management and problem-solving skills are the key to handling problems efficiently.

5. Controls

According to the central limit theorem, standard normal (Z) distribution can be applied if there are a large number of samples. The control chart will have three standard deviations (σ) as control limit; that is, the critical point is $Z = \pm 3$, and $P(-3 \le Z \le 3) = 99.73\%$. Therefore, the upper and lower bounds for control in the measure index will be:

$$P(-3 \le Z \le 3) = P\left(-3 \le \frac{\sqrt{kU}(w-v)}{\sqrt{v}} \le 3\right) = 99.74\%,$$

$$P(v - 3\sigma \le w \le v + 3\sigma) = 99.73\%,$$

where

$$\sigma = \sqrt{\frac{v}{kU}}.$$

Then, we have the upper and lower bounds for control as well as the center line of w:

$$\text{UCL} = v + 3\sqrt{\frac{v}{kU}},$$

$$\text{CL} = v,$$

$$\text{LCL} = v - 3\sqrt{\frac{v}{kU}}.$$

Since v is an unknown number, we use the mean of w in multiple samples, $\overline{w}$, as v, then we have

$$\text{UCL} = \overline{w} + 3\sqrt{\frac{\overline{w}}{kU}},$$

$$\text{CL} = \overline{w},$$

$$\text{LCL} = \overline{w} - 3\sqrt{\frac{\overline{w}}{kU}}.$$

where

$$\overline{w} = \frac{1}{m} \times \sum_{i=1}^{m} \bar{I}_{L_i}.$$

Thus, we can monitor whether the service failure is under control based on the above calculations.

6. Conclusions

Fitness clubs feature a short-period service and emphasize customers' impressions, thus service failure is inevitable. However, more and more fitness club operators have realized and attached importance to service failure recovery, hoping to reduce the occurrence of service failure and optimize customer satisfaction. This study adopts the five-step Six Sigma process of improvement. First, one must define the occurrence of service failure. Secondly, use the number of occurrences to determine a measure index and find out the measure criterion. Then, use Pyzdek's (2001) theory to construct a cause and effect diagram. This diagram will be an analytical tool for the third step. The forth step is to use the causes to determine the responsibilities of each department based on Quality Function Deployment, and also to correct any deficiencies. Finally, use the measure in the second step to verify whether the step is feasible. If it has met the standard, use the criterion for further control. The five-step Six Sigma Methodology can effectively minimize service failures while improving customer satisfaction and service quality. Most importantly, it keeps enterprises operating.

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